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Spatial complementarity of FDI: example of transition countries

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Abstract

This paper investigates spatial determinants of FDI location. In particular, FDI in neighboring countries and foreign market potential are two variables it focuses on. The sample includes a panel of 27 transition countries in 1993-2007.

The spatial links are found positive and economically large. Omitting spatial FDI leads to a serious misspecification of the model and biases estimation of the coefficient of the foreign market potential variable, which is found to be a non-robust determinant of FDI location. As the analysis of sub-samples of the data indicates, the FDI complementarity is stronger for the CIS countries and for earlier period.

The spatial complenmentarity is stronger for disaggregated data such as bilateral FDI flows and industry level data. I find substantial heterogeneity of spatial FDI spillovers across industries. Spillovers are large and positive for services sectors and non-sighificant or even negative for manufacturing sectors.

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1. Introduction

During the last two decades, the global economy experienced an unprecendeted growth of foreign direct investment (FDI) flows that considerably outperformed growth of trade flows and growth of GDP. According to Navaretti et al. (2004), the global FDI between 1985 and 1999 increased at a rate 17.7 percent per year, while the global GDP grew 2.5 percent, and the global export grew 5.6 percent. Given such a strong FDI growth globally, the rise of the Eastern Europe and Central Asia (ECA) region as one of the major destinations of FDI, increasing the share of FDI inflow to the region from virtually zero before 1990 to 6.2 percent of global FDI inflows in 2002-2004, is even more outstanding. What factors explain growing attention of multinationals to the ECA region? The literature suggests that the opening up of economies, rapid economic and institutional transformation, combined with a relatively low unit labor cost and educated population were very important[1].

At the same time, economic and institutional changes within a country do not exhaust the potential list of factors that affect the FDI location decisions. The main goal of the paper is to investigate FDI determinants that go beyond country characteristics. First, there is a third-country effect that, with a few exceptions ((Blonigen et al., 2007, Baltagi et al., 2007)), is ignored in the literature on FDI location. The FDI inflows in the neighboring countries can have a spillover effect on FDI inflow in a country that can be either negative or positive. On the one hand, when countries A and B compete to host FDI, developments that improve investment climate in the country A can have a negative effect on FDI inflows to the country B due to competition across countries.

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[1]The determinants of the FDI activities in the region were discussed, among others, by Bevan and Estrin (2004), Carstensen and Toubal (2004), Lane and Milesi-Ferretti (2007)

At the same time, multinational companies (MNC) might benefit from the external agglomeration economies, and learn from experience of other MNCs that entered the market earlier. In this case, a positive spillover effect of can be observed. Second, proximity to large markets, resulting in good market access, is an important factor that attracts FDI, especially in the case of export platform driven FDI to countries with small internal markets but with good access to large regional markets (Head and Mayer, 2004).

I study how two spatially determined variables – the FDI stock accumulation in the neighboring countries and foreign market potential – influence the FDI inflows. Blonigen et al. (2007) investigated a similar question, looking at the spatial determinants of US outbound FDI activity and found that the spatial interactions are not robust to inclusion of country fixed effects and sensitive to the sample of countries one examines. However, their study did not take into account the interaction of US multinationals with multinationals from other countries, which is likely to underestimate the spatial interactions. In addition their sample covered only 35 FDI destinations, primarily high-income OECD countries, which also could lead to underestimation of the spatial interactions, because, as demonstrated in this paper, the spatial interactions are more important for developing countires with lower levels of FDI activity.

To study the spatial interactions at various stages of development, I have chosen transition countries in 1993-2007. It gives the advantage of looking at countries that have started with virtually zero FDI stock and gradually developed into economies with high foreign presence, opening widely to the globalization processes. In addition, the transition countries vary substantially across important economic and policy dimensions, including the speed and scope of reforms, market potential, and industrial structure. The main findings of the paper are as follows. First, there is a robust, economically and statistically significant association between the spatial lag of accumulated FDI stock and the FDI inflows, with elasticity ranging from 0.3 to 0.54. The effect is the strongest for the Commonwealth of Independent States (CIS) countries in the 1993-2000 period, while it is not significant for the Eastern European (EE) countries in 2001-2007. Second, omitting the spatial interaction term substantially overestimates the impact of other spatially correlated variables – foreign market potential and progress of reforms. Importantly, the foreign market potential is not a robust determinant of the FDI inflows once the spatial spillovers are accounted for. The foreign market potential plays an important role for the EE countries in 2001-2007, but it is not significant either for the whole sample or for the CIS countries. Third, the spatial interactions are stornger for more disaggregated data, as the analysis of bilateral flows and industry level flows reveals.

Finally, the spatial interactions are more important for emerging industries rather than for established ones. For example, they are stronger for services sectors, which were underdeveloped under socialism, and significantly weaker in manufacturing, which was relatively well-developed. These findings point that the spatial interactions between MNCs are more important at the early stages of development when the overall stock of FDI is low. At that stage, any new entrant creates a substantial positive spillover effect because it provides new goods and services which probably were not available before and reduces information uncertainty for other MNCs, considering entering the market. Over time, however, the market matures and additional foreign companies bring lower benefits due to diminishing returns to scale while impose higher costs on other foreign companies due to hightened competition.

The structure of the paper is as follows. Section 2 discusses the FDI deternimants mentioned in the literature. Section 3 sets up the model and discusses the empirical strategy. Section 4 discusses the sources of data. Section 5 presents the main results. Section 6 presents an additional set of results for more disaggregated FDI data. Finally, section 7 concludes.

2. Determinants of FDI

2.1. Spatial determinants of FDI

A choice of FDI location is often a multi-stage process that involves evaluation and comparison of investment opportunities in different countries, creation of the shortlist of countries, and finally a head-to-head competition of physical locations within the shortlisted countries. Under such circumstances, high economic growth, regional integration, and rapid institutional improvements in one country could influence FDI in neighboring countries. The sign and magnitude of the spatial correlation between FDI would depend on the dominant mode of FDI activities for the whole region. Broadly speaking, the literature on FDI distinguishes between vertical and horizontal FDI modes. A vertical MNC fragments production into stages and locates production facilities to minimize the cost of production. Helpman (1984) is one of the examples of the vertical model of FDI. A horizontal MNC, on the other hand, is a multiplant firm that replicates the same activities in different locations. The main motive for the horizontal FDI is the search for new markets that are cheaper to serve through local production rather than through export. Markusen (1984) is an example of a work that models horizontal FDI. More recent works emphasize that MNCs become increasingly multi-mode, complex types of firms that combine vertical and horizontal FDI (Yeaple, 2003). As an example, Ekholm et al. (2007) present an export platform mode of FDI – a modification of the horizontal FDI which aims to serve neighboring countries by exporting.

Blonigen et al. (2007) argue that the simple vertical and export platform FDI would generate negative spatial correlation. Locating a plant in one country under both modes means that a similar plant is not being built in a neighboring country. The complex vertical FDI, on the other hand, would generate positive spatial correlation. Other things being equal, it is better to locate different stages of production close to each other. There are evidence of substantial agglomeration effects on FDI (Amiti and Smarzynska Javorcik, 2008, Head and Mayer, 2004, Carstensen and Toubal, 2004) which would lead to a positive spillover effect from one country to another due to increasing returns to scale at industry level, wider choice of suppliers, and more developed services sector.

Another important spatial characteristic of the country that influences FDI inflows is market potential. Head and Mayer (2004) analyzed the patterns of location of Japanese MNCs in Europe and found the positive impact of market potential on location choice. However, Head and Mayer mentioned that the market potential alone could not explain entirely the tendency of firms to agglomerate. It should be mentioned that they did not include the spatial lag of FDI in their model specification, which might partially explain the missing agglomeration factors. More importantly, as shown in this paper the ommited variable could bias their result.

The main goals of this paper is to estimate the sign of the spatial interactions and determine what is the dominant FDI motive to the region. There are several papers that deal with the third-country effect on FDI by means of spatial econometrics. Coughlin and Segev (1999) is the first study that estimated a model of FDI determinants with the spatial autoregressive process in the dependent variable using data on the Chinese provinces. They found that a higher level of FDI in the adjacent provinces increased FDI, pointing to a positive external agglomeration effect. Baltagi et al. (2007) found a substantial third-country effect in US outward FDI stocks in 1989-1999, however, they did not include a term that would capture the spatial FDI effect.

The closest to the approach implemented in this paper is Blonigen et al. (2007) who estimates a spatial autoregressive model of FDI that also include a spatial lag of GDP for a panel of US outbound FDI activity into 35 countries in 1983-1998. The coefficient of the spatial lag of FDI in their baseline result is positive and significant while the coefficient of the spatial lag of GDP is surprisingly negative. However, they mention that their main result is sensitive to inclusion of the fixed effects and to the choice of the estimated sample. However, as menitioned earlier, their findings might be driven by the fact that they ignore interactions of the US multinationals with MNCs from other countries and by not accounting for influence of countries that are not included in the sample. In addition, Bloningen et al. focus on developed countries while this paper demonstrates that the spatial FDI stock influcence on the FDI inflows is stronger in emerging economies.

2.2. Traditional determinants of FDI

Ideally, it is important to separate the FDI inflows based on the MNC mode, but it is very difficult to implement due to lack of data. Markusen and Maskus (2002) empirically test which set of theories – on horizontal, vertical, or complex FDI – is better explained by the data. They nest a horizontal and vertical model within a unifying "knowledge-capital model" and test the unifying model on US data. In the tests, the restricted horizontal model performs as good as the unrestricted model that indicates that the horizontal FDI model captures all FDI determinants. The tests overwhelmingly reject the vertical model. Other authors confirmed that the majority of FDI is of the horizontal type, hence, in this work the most attention is paid to factors that attracts the horizontal FDI. Based on these findings, the model presented in the next section is based on the horizontal FDI motives.

What does attract FDI to a specific country? A market size and broader regional market potential are both important determinants of the horizontal FDI (Head and Mayer, 2004). Membership in the regional integration agreements is also important because it facilitates the market access for the member countries and diverts investment from countries that are not integrated. Egger and Pfaffermayr (2004), who specifically studied how EU integration influenced FDI into and within the EU, report an anticipation effect – FDI inflows pick up after the integration is announced but before it actually takes place. Trade and transport costs can affect FDI both ways, depending on the FDI type (Brainard, 1997, Carr et al., 2003). Since aggregate flows are dominated by horizontal FDI, seeking to supply new markets, literature views such FDI as a substitute for trade flows, hence, higher trade barriers induce tariff jumping FDI (Ekholm et al., 2007). If, on the other hand, the MNC searches for a location with low factor costs, the higher trade barriers would have a negative effect on FDI inflows. Production costs and factor endowments, including capital, labor, and human capital, are particularly important determinants of the vertical FDI. A vertically integrated MNC would locate the capital intensive stages of production in capital abundant counitres and labor intensive stages in labor abundant counties (Helpman, 1984).

Turning to the literature on the FDI determinants in developing and transition countries, the factor that is robustly significant and economically important in a number of studies is the quality of institutions protecting the rule of law, encouraging competition, and creating favorable investment climate. Alfaro et al. (2008) show that, during 1970-2000, low institutional quality was the leading explanation of why capital doesn't flow to poor countries. Globerman and Shapiro (2002) stress that the MNC activities are strongly encouraged by good governance infrastructure, a concept that includes political, institutional, and legal environment. Javorcik and Wei (2009) look at the interaction between the level of corruption and find that high corruption lowers inward FDI and shift the organizational structure towards joint ventures because local partners have a required skills to cut through bureaucracy.

Focusing on transition countries gives an opportunity to look how rapidly changing environment influence FDI. Bevan and Estrin (2004), who investigated the determinants of FDI inflows in transition countries, stress that in addition to traditional factors mentioned in the literature, an EU accession announcement increases levels of FDI in prospective countries. Carstensen and Toubal (2004) find that the extent and mode of privatization and country risk both play an important role in determining FDI in transition countries. Campos and Kinoshita (2003) using a panel of 25 transition countries between 1990 and 1998 report that institutions, natural resources, agglomeration economies, and labor costs are main determinants of FDI inflows.

3. Methodology

3.1. Model

Consider N locations, each having two sectors. A traditional sector, H, produces a homogeneous good using a constant return to scale technology $Y_H = L_H$, where L is labor – the only factor of production. A modern sector, F, consists of MNCs that bring new technologies and products. The modern sector produces differentiated goods indexed $l = 1...M$ under increasing return to scale technology. Each variety can be either produced at home or imported from another location. However, transportation is costly. Labor is mobile across sectors and firms within one location, but not across different locations. Total amount of labor, L_i is exogenously given in each location.

A representative consumer has the following utility function

$$U = (C_F)^{\mu}(C_H)^{1-\mu}, 0 < \mu < 1$$

where

$$C_F = \sum_{l=1}^{M} (c_l)^{(\sigma-1)/\sigma}, \sigma > 1.$$

An MNC, located in country i, has a technology $l = F_i + c_i q^2$, where F_i is a fixed cost that includes an overhead production cost, f, and an additional cost of forming a subsidiary in a foreign country, f_i, c_i is a marginal cost, q is an output, and l is amount of labor. Under the monopolistically competitive structure of the market with trade costs, τ_{ij}, and possibility to trade across countries, a firm located in country i faces the following demand for its product in country j

$$q_{ij} = \frac{\sigma-1}{\sigma}\frac{(c_i\tau_{ij})^{-\sigma}}{P_j^{1-\sigma}}\mu Y_j$$

where Y_j are expenditures, and

$$P_j = (\sum_{i=1}^{N} n_i(c_i\tau_{ij})^{1-\sigma})^{1/(1-\sigma)}.$$

n_i is the number of varieties produced in country i, as well as the number of firms in the modern sector. To start production in country i, a multinational firm incurs F_i and earns the aggregate net profit from selling in country i and exporting to all other countries

$$\Pi_i = \frac{\mu c_i^{1-\sigma}}{\sigma}M_i - F_i$$

where $M_i = \sum_{j=1}^{N}\frac{\tau_{ij}^{1-\sigma}Y_j}{P_j^{1-\sigma}}$ is the Krugman market potential (Krugman, 1992). Assuming free entry that drives net profits to zero, the equilibrium requires

$$F_i = \frac{\mu c_i^{1-\sigma}}{\sigma}M_i.$$

To determine the equilibrium number of MNCs in the country, the full employment in the economy is used

$$L_i = L_{Hi} + L_{Fi} = Y_{Hi} + n_i(F_i + c_i y_i)$$

where

$$y_i = \sum_{j=1}^{N} q_{ij}\tau_{ij}$$

Productivity of a modern sector firm varies from one location to another and depends on the presence of multinationals in the nearby locations

$$c_i = \frac{c_{i0}}{\varphi_i(n_1F_1, ..., n_NF_N)}$$

with $\partial\varphi_i(.)/\partial(n_jF_j) > 0, \forall j = 1\dots N$. The cost specification captures the idea of Marshallian economies of scale where external size of the modern sector has a positive effect on the firm level productivity. For example, other MNCs located in the neighboring countries can have an impact

[2] Each MNC is associated with one product variety l. All firms located in the same country i produce according to the same technology. For ease of presentation, I drop the product index.

on the cost of production by providing a better supplier access in upstream industries due to tighter competition and wider choice of inputs (Amiti and Smarzynska Javorcik, 2008)[3].

The equilibrium allocation of FDI in the region is a solution of a non-linear system

$$F_1 = \frac{\mu c_{10}^{1-\sigma}}{\sigma\varphi_1(n_1F_1,...,n_NF_N)^{1-\sigma}}M_1 \quad (1)$$
$$...$$
$$F_N = \frac{\mu c_{N0}^{1-\sigma}}{\sigma\varphi_N(n_1F_1,...,n_NF_N)^{1-\sigma}}M_N$$

Further assume that the productivity is represented by the following functional form

$$\varphi_i(n_1F_1,...,n_NF_N) = A_i \times exp(\nu_i) \times \prod_{j=1}^{N}(n_jF_j)^{\rho w_{ij}}$$

where, $|\rho| < 1$ is a parameter that captures degree of spatial dependence, A_i is a productivity factor, w_{ij} is an exogenous weight that relates spatial units i and j, $0 \leq w_{ij} \leq 1$, and $w_{ii} = 1$. ν_i is a disturbance term.

Suppose that FDI in other locations are at the equilibrium level, F_j^*. It can be shown that

$$n_iF_i^* = \left(\frac{n_i\mu c_{i0}^{1-\sigma}}{\sigma(A_i \times exp(\omega_i) \times \prod_{j=1,j\neq i}^{N}(n_jF_j^*)^{\rho w_{ij}})^{(1-\sigma)}}M_i\right)^{1/(1-\rho)} \quad (2)$$

Finally, taking logs on both sides of (2) the estimation equation looks as follows

$$ln(n_iF_i^*) = \xi_i + \lambda\sum_{j=1}^{N}w_{ij}ln(n_jF_j^*) + \frac{1}{(1-\rho)}ln(n_i) +$$
$$\frac{1}{(1-\rho)}ln(M_i) - \frac{(\sigma-1)}{(1-\rho)}ln(c_{i0}) + u_i \quad (3)$$

where $\xi_i = \frac{1}{1-\rho}[ln(\mu/\sigma) + (\sigma-1)ln(A_i)]$, $\lambda = \frac{(\sigma-1)\rho}{(1-\rho)}$, and $u_i = \frac{(\sigma-1)}{(1-\rho)}\nu_i$.

Based on the discussion, the following prediction can be made. The elasticity of FDI to a country i with respect to FDI to a country j is described as

$$\frac{\partial ln(n_i^*F_i)}{\partial ln(n_j^*F_j)} = \lambda w_{ij} \geq 0 \quad (4)$$

3.2. Estimation strategy

I build on Kelejian and Prucha (1998) and Kapoor et al. (2007) and estimate an empirical counterpart of (3) that includes the spatial lag of the dependent variable as well as the market potential and other controls, construction of which is discussed in the next section. The model has $i = 1,...,N$ countries and $t = 1,...,T$ time periods. For a time period t, the specification can be written in a compact form as

$$lnFDI(t) = X(t)\beta + \lambda WlnFDI(t) + u(t), |\lambda| < 1 \quad (5)$$

or

$$lnFDI(t) = Z(t)\delta + u(t) \quad (6)$$

[3]Alternatively, positive spillovers that increase firm-level productivity can come through technology diffusion (see Keller (2004) on the role of FDI in spreading of technology and spatial nature of diffusion).

where $lnFDI(t)$ is an $N \times 1$ vector with observations on the dependent variable in year t, $X(t)$ is an $N \times K$ matrix on K explanatory, non-stochastic variables. W is an $N \times N$ time-invariant weighting matrix, with elements $w_{ij}$are known and non-stochastic. The element $WlnFDI$ is referred to as the spatial lag of $lnFDI$. β is a $K \times 1$ vector of estimated parameters and λ is a scalar that measures the degree of the spatial dependence. In equation (6), $Z(t) = [X, WlnFDI]$ is a $N \times (K+1)$ matrix, and $\delta = (\beta', \lambda)'$ is a $(K+1) \times 1$ vector of estimated parameters.

The error term u is modeled as a random error component

$$u(t) = \mu + v(t) \tag{7}$$

where $u(t)$ is an $N \times 1$ vector of error terms, consisting of time-invariant component μ and time-varying component $v(t)$[4]. Specifically, I assume that the $i-th$ element of $u(t)$ has the following form $u_{it} = \mu_i + v_{it}$ where μ_i is $i.i.d.$ over i with $(0, \sigma_\mu^2)$ and v_{it} is $i.i.d.$ over both i and t with $(0, \sigma_v^2)$.

Stacking observations for all time periods, the specification is

$$lnFDI = X\beta + \lambda WlnFDI + u = Z\delta + u \tag{8}$$

with $lnFDI = (LnFDI(1)', ..., LnFDI(T)')'$, $X = (X(1)', ..., X(T)')'$, $Z = (Z(1)', ..., Z(T)')'$ and $u = (u(1)', ..., u(T)')'$.

The error term can be written as

$$u = (e_T \otimes W)\mu + v \tag{9}$$

where $v = (v(1)', ..., v(T)')'$ and $\mu = (\mu_1, ..., \mu_N)'$ is an $N \times 1$ vector of country-specific error components, I_T is a $T \times T$ identity matrix, and e_T is a $T \times 1$ vector of ones. Among other things, the model implies that $E(uu') = \sigma_\mu^2(e_T e_T' \otimes I_N) + \sigma_v^2 I_{NT} = \Omega_u$.

Consider the following transformation of (8)

$$\Omega_u^{-1/2} lnFDI = \Omega_u^{-1/2} Z\delta + \Omega_u^{-1/2} u \tag{10}$$

or

$$lnFDI^* = Z^*\delta + u^* \tag{11}$$

where $Eu^*u^{*'} = \sigma^2 I_{NT}$

Obviously, the spatial lag of $lnFDI^*$ is an endogenous variable correlated with the error term u^*. In fact, any element of $lnFDI^*$ depends not only on its exogenous characteristics X_i^* and its disturbance u_i^*, but also on the rest of the elements of X^* and u^*. To demonstrate this, the model (11) can be rewritten in a reduced form

$$lnFDI^* = GX^*\beta + Gu^* \tag{12}$$

where $G = (I - \lambda W)^{-1}$.

Under assumption $|\lambda| < 1$, it can be shown that $G = \sum_{i=0}^{\infty} \lambda^i W^i$ and the expected value of $lnFDI^*$ can be presented as an infinite sum

$$E(lnFDI^*|X^*) = X^*\beta + \lambda WX^*\beta + \lambda^2 W^2 X^*\beta + ... \tag{13}$$

Importantly, the orthogonality condition $E(W^i X^* u^*) = 0$ holds.

Given the orthogonality condition holds and $lnFDI$ depends on the spatial lags of exogenous variables, the spatial autoregressive model makes instruments readily available. The optimal set

[4]The previous version of the paper (Shepotylo, 2005) had a spatial autoregressive error structure similar to Kapoor et al. (2007). Accounting for the spatial autocorrelation in the error does not significantly influence the estimation of the coefficients in the model. More importantly, as shown by Badinger and Egger (2009), to estimate the parameters of such model with a good precision, one would need around 200 spatial units.

of instruments for $Z^* = [X^*, WY^*]$ is $H^{opt} = [X^*, E(lnFDI^*|X^*)]$, however, the following subset of instruments, $H = [X^*, WX^*]$ is sufficient set of instruments for estimation. The spatial 2SLS estimator is defined as

$$\hat{\delta} = (\hat{Z^*}' Z^*)^{-1} \hat{Z^*}' lnFDI^* \tag{14}$$

where $\hat{Z^*} = H(H'H)^{-1}H'Z^*$.

4. Data and variables

To test the model, I define the following variables, listed in Table 1, and discuss their construction. I build a panel of 27 transition countries over the period 1993-2007. The United Nations Conference on Trade and Development (UNCTAD) compiles annual data on foreign direct investment inflows in millions of current US dollars. Figures for FDI inflow values are converted into millions of 1990 US dollars using US GDP deflator taken from the World Development Indicators (WDI) of the World Bank to make the data comparable across time periods. The FDI inflow in the log form is further used in the analysis as the dependent variable[5].

The gross domestic product in millions of current US dollars taken from the WDI is converted into millions of 1990 US dollars, deflated by the US GDP deflator. Labor costs are approximated by the monthly wage in local currency in manufacturing, available from the International Labor Organization,[6] converted to the real monthly wages by implied PPP conversion rates between local currency and US dollar provided by World Economic Outlook database constructed by the International Monetary Fund (IMF).

To construct a measure of governance quality that includes progress of economic and institutional reforms, I use the Transition Report, published by the European Bank of Reconstruction and Development (EBRD). The Transition Report provides a broad, comprehensive, and comparable across countries description of the progress of reforms in all transition countries, starting from 1989. An integral measure of governance quality is computed as a simple average of the indicators of government reforms in large scale privatization, small scale privatization, enterprise restructuring, prices liberalization, trade and exchange rate liberalization, competitiveness, banking sector, and financial sector. All indices are measured on a scale from 1 to 4.3 with higher numbers representing a greater progress.

Because of their heterogeneity, transition countries have different sectoral composition of FDI. To account for a high volume of investment in oil and gas industries in Russia, Kazakhstan, Azerbaijan, and Turkmenistan, I control for natural resources endowment of the economy. The measure of importance of the oil industry is log of proven oil reserves reported by BP[7]. Finally, I construct an EU indicator variable, with 1 meaning EU membership and 0 otherwise, to control for the impact of EU enlargement process on FDI.

4.1. Spatial variables

I construct two spatial variables that measure FDI activities in the neighboring countries. The first variable, the spatial lag of log of FDI inflow, $WlnFDI_{it}$, is constructed using information on FDI inflows to all countries in the world. Using all available data, I control for the impact of out-of-sample countries on FDI inflows to transition economies, taking into account the impact of

[5]Several observations of FDI inflows are less than or equal to zero. I define the dependent variable as $lnFDI = ln(1 + FDI)$. The choice of the additive constant does not change the main conclusions of the paper. There are also 4 observations with substantially negative FDI inflows that are dropped from the analysis.

[6]In rare cases, where the data is not available, I use either data for monthly wages in all activities or official data from country statistical offices (for Russia and Belarus).

[7]Separate data for oil and gas is aggregated into one variable measured in millions of barrel using a conversion factor provided in the BP report – 1bcm of gas is equal to 6.6 millions barrel equivalent. The report includes only countries with substantiall amout of oil and gas resources, it also gives information on total amount of oil and gas in all other countries in the region. To compute values for countries not included in the report, I assume that the remaining totals are distributed among all those countries proportionally to their geographical sizes.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Ln FDI	5.847	1.824	0	10.522	376
Spatial lag of Ln FDI stock	6.075	0.913	3.74	8.129	376
Ln GDP per capita	7.362	1.054	4.718	9.665	376
Ln of population	15.778	1.081	14.109	18.816	376
ln of Foreign market potential	20.605	0.971	18.488	22.999	376
EU membership	0.09	0.287	0	1	376
EBRD index	2.878	0.655	1.166	4	376
Ln of proven oil and gas reserves	-1.428	2.735	-3.912	5.904	376
Ln of Real wage	6.060	0.749	3.649	7.512	376

Notes: A panel of 27 transition countries from 1993 to 2007. Data on FDI inflows is from UNCTAD. GDP and population are from WDI. EU membership is constructed based on official announcments of European Comission. EBRD index is the simple average of eight Transition indicators published by EBRD, higher numbers represnt better progress. Oil and gas reserves are from the BP report. Real wage is computed based on ILO data on monthly wages in manufacturing. Nominal variables are converted to real indicators having 1990 as the base year.

FDI inflows to, for example, Germany, on FDI inflows to the Czech Republic. The second variable, the spatial lag of log FDI stock $WlnFDIstock_{it}$, is computed in similar fashion using information on FDI stock. The stock of FDI is constructed using the stock of FDI in 1992 measured in US dollars of 1990 as the initial value of the stock of foreign capital. Further, the stock of FDI in 1993-2007 is computed based on the perpetual inventory model $K_{it+1} = (1-\delta)K_{it} + FDI_{it}$ where K is the stock of foreign capital, δ is the depreciation rate, and FDI is the FDI inflow measured in US dollars of 1990. The rate of depreciation is taken equal to 0.06 as it is usual in the literature (i.e. Nadiri et al. (1997)).

I use both spatial variables in empirical analysis, because each has its advantages and disadvantages. The use of the spatial lag of log FDI inflow better captures the spatial autoregressive (SAR) process specification, while the usage of the spatial lag of log FDI stock is a better proxy for the theoretical model.

4.2. Foreign market potential

The foreign market potential is computed according to the methodology developed by Head and Mayer (2004). At the first stage, the gravity equation is estimated on the panel of bilateral exports between 183 countries in the world for which data is available from the COMTRADE database. Since the COMTRADE data for most transition countries starts in 1996, I add the trade data in 1993-1995 from the Direction of Trade database by the IMF. The gravity specification that includes exporter and importer fixed effects as well as variables that capture trade costs is estimated separately for each year

$$lnX_{ij} = EX_i + IM_j + \rho \cdot ln(dist_{ij}) + \gamma B_{ij} + \delta \cdot Colony_{ij} + \sigma \cdot Language_{ij} + \epsilon_{ij}$$

where X_{ij} is export from i to j, EX_i and IM_j are exporter and importer fixed effects, $dist_{ij}$is a bilateral distance, B_{ij} is an indicator variable that takes the value of 1 if countries share a common border and 0 otherwise, $colony_{ij}$ is an indicator variable that takes value of 1 if one of the countries was a colony of another and 0 otherwise, and $language_{ij}$ is an indicator variable that takes value of 1 if countries share common language and 0 otherwise. All data is available from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). At the second stage, the foreign market potential is calculated as $FMP_{it} = \sum_{j \neq i} \hat{\phi_{ij}} exp(\hat{IM}_j)$, where $\hat{\phi}_{ij} = dist_{ij}^{\hat{\rho}} exp(\hat{\gamma} B_{ij})$. The results presented in Table 2 are consistent with prior expectations about the magnitude of the foreign market potential; namely, FMP is higher for countries that have large economies nearby and for countries that are closer to more developed EU countries.

Table 2: Foreign market potential, trillions of 1990 US dollars

Variable	Mean	Std. Dev.	Min.	Max.
Albania	1.17	0.65	0.51	2.62
Armenia	0.5	0.28	0.19	1.12
Azerbaijan	0.46	0.23	0.23	1
Belarus	1.19	0.61	0.6	2.71
Bosnia and Herzegovina	1.57	0.92	0.65	3.66
Bulgaria	1.46	0.88	0.38	3.41
Croatia	1.94	1.07	0.88	4.34
Czech Republic	4.42	2.33	1.65	9.65
Estonia	1.09	0.55	0.55	2.39
Georgia	0.47	0.24	0.23	1.06
Hungary	1.93	1.12	0.81	4.58
Kazakhstan	0.43	0.24	0.11	1.01
Kyrgyz Republic	0.31	0.19	0.12	0.74
Latvia	1.11	0.58	0.52	2.5
Lithuania	1.2	0.63	0.54	2.68
Macedonia, FYR	1.18	0.67	0.5	2.66
Moldova	0.87	0.51	0.38	2.11
Poland	5.01	2.11	1.85	9.73
Romania	0.91	0.47	0.43	1.96
Russian Federation	0.42	0.21	0.18	0.88
Serbia and Montenegro	1.23	0.75	0.37	2.91
Slovak Republic	2.67	1.4	1.03	5.69
Slovenia	3.54	1.99	1.39	8.12
Tajikistan	0.25	0.15	0.12	0.6
Turkmenistan	0.26	0.14	0.12	0.59
Ukraine	0.71	0.37	0.27	1.59
Uzbekistan	0.23	0.12	0.09	0.5

Notes: Foreign market potential variable is constructed by projecting the gravity model coefficient estimates on importer's fixed effects and bilateral trade costs: distance, commond border, common language. The gravity model is estimated on the sample of 183 countries in the period from 1993 to 2007. The table reports the period average value of the foregin market potential, standard deviation, minimum and maximum value for the period.

4.3. Weighting matrices

In the baseline model specification, I define weights between countries i and j, w_{ij}, to be the inverse of the square distance between them[8], where distance, d_{ij}, is the weighted distance measure , computed using city-level data to assess the geographic distribution of population inside each country. The diagonal elements of the weighting matrix are set equal to zero. Furthermore, I scale each row i of the weighting matrix by $k_i = 1/\sum_{j=1,j\neq i}^{N} 1/d_{ij}^2, \forall i = 1, 2, ..., N$ in order to row-normalize it

$$W_1 = \begin{pmatrix} 0 & k_1/d_{12}^2 & ... & k_1/d_{1N}^2 \\ k_2/d_{21}^2 & 0 & ... & k_2/d_{2N}^2 \\ ... & ... & ... & ... \\ k_N/d_{N1}^2 & k_N/d_{N2}^2 & ... & 0 \end{pmatrix} \tag{15}$$

Row-normalization is necessary to ensure the system stability. Under this specification, the system converges to a global spatial equilibrium when $|\lambda| < 1$ (Kelejian and Prucha, 1998). In addition, the row-normalized weighting matrix gives a clear economic interpretation of the spatial lag of a variable as its weighted average.

The choice of the weighting matrix can be criticized as being ad hoc and not backed by the theory. The criticism would underemine the results if they are sensitive to the choice of the weighting matrix. To explore how the estimation is influenced by the weighting matrix, I consider an alternative, contiguity-based matrix specification. The contiguity-based weighting matrix attaches more importance to the direct neighbors, while disregards influence of the countries that do not share the border. According to this specification, two units are neighbors only if they share a common border

$$w_{ij} = \begin{cases} 1 & \text{if } i \text{and } j \text{share common border} \\ 0 & \text{otherwise} \end{cases}$$

The weighting matrix is row-normalized to ensure convergence of the estimation procedure

$$W_2 = \begin{pmatrix} 0 & k_1 w_{12} & ... & k_1 w_{1N} \\ k_2 w_{21} & 0 & ... & k_2 w_{2N} \\ ... & ... & ... & ... \\ k_N w_{N1} & k_N w_{N2} & ... & 0 \end{pmatrix} \tag{16}$$

where $k_i = 1/\sum_{j=1}^{N} w_{ij}, \forall i = 1, 2, ..., N$

5. Results

5.1. Baseline model

Table 3 presents the results of the regression of FDI inflow on the spatial lag of FDI stock and set of independent variables. The most important result is the substantial spatial complementarity of FDI in the region – higher accumulation of the FDI stock in the region induces FDI inflows in countries of the region. The positive coefficient of the spatial lag of log FDI stock points that a MNC gains from accumulation of technology brought by other MNCs, wider choice of multinational suppliers, and as a results, less costly inputs more than it loses due to competition across countries and across different MNCs. The result is robust to different model specifications. The elasticity of FDI inflows to the spatial lag of FDI stock ranges from 0.3 to 0.54. In the baseline model specification, reported in column (1), the elasticity is 0.42 that is close to the mean value across different model specifications. The positive and significant coefficient of EBRD index across all model specifications highlights importance of good governance in attracting MNCs, a factor that is

[8]The inverse distance squared weights give higher weights to closer countries. I also estimated and presented the results of the model with weights inversly related to distance, which assign higher importance to influence of remote countries. The choice of the weighting matrix did not have impact on the conclusions of the paper.

found to be one of the most important in other studies as well[9]. Another factor that is important in almost all specifications is energy resources endowment of a country that induces resource-seeking FDI inflows.

Table 3: Aggregate FDI inflows in transition countries: 1993-2007. Spatial lag of FDI stock.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spatial lag of ln FDI stock	0.41**		0.34**	0.32**	0.54**	0.40**	0.30**	0.32**
	(0.087)		(0.084)	(0.089)	(0.10)	(0.10)	(0.12)	(0.11)
Ln GDP per capita	0.61**	0.30*		0.53**	0.78**	0.65**	0.69**	0.44*
	(0.15)	(0.13)		(0.14)	(0.16)	(0.15)	(0.19)	(0.19)
Ln of population	0.37*	0.10	0.28	0.31*	0.40*	0.33*	0.71	0.21
	(0.16)	(0.15)	(0.16)	(0.14)	(0.17)	(0.15)	(1.28)	(0.17)
Ln of foreign market potential	0.24	0.87**	0.47**	0.40*	0.011	0.26	0.22	0.57*
	(0.19)	(0.14)	(0.18)	(0.18)	(0.21)	(0.20)	(0.24)	(0.27)
EU membership	-0.25	-0.22	-0.22	-0.25	-0.31	-0.30	-0.23	-0.52*
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.25)
EBRD index	0.83**	1.30**	0.93**	0.89**	0.74**	0.90**	1.09**	0.88**
	(0.17)	(0.13)	(0.16)	(0.16)	(0.17)	(0.17)	(0.25)	(0.19)
Ln of proven oil and gas reserves	0.25**	0.41**	0.30**	0.28**	0.22**	0.27**	0.32	0.33**
	(0.071)	(0.063)	(0.069)	(0.070)	(0.075)	(0.068)	(0.39)	(0.082)
Ln of real wage	-0.26	-0.025	-0.014	-0.22	-0.35*	-0.27	-0.17	-0.21
	(0.15)	(0.14)	(0.15)	(0.14)	(0.15)	(0.15)	(0.16)	(0.20)
L.Ln GDP per capita			0.39**					
			(0.13)					
Infrastructure sector reform				0.046		-0.038		
				(0.14)		(0.14)		
Ln human capital					-0.34	-0.12		
					(0.54)	(0.48)		
Constant	-13.0**	-18.8**	-15.03**	-14.4**	-9.55*	-12.9**	-18.9	-15.6**
	(3.05)	(2.85)	(3.01)	(2.76)	(4.29)	(3.87)	(20.1)	(3.50)
R-sq. within	0.65	0.65	0.64	0.65	0.67	0.67	0.66	0.77
R-sq. bitween	0.90	0.89	0.90	0.91	0.89	0.90	0.87	0.91
R-sq. overall	0.81	0.80	0.81	0.81	0.81	0.81	0.78	0.87
Observations	376	376	376	376	361	361	376	130

Notes: Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

All regressions are estimated by 2SLS method using spatial lags of exogenous varaibles as instruments. Dependent variable in all regressions is ln FDI inflow. Column (1) reports the baseline regression. Column (2) reports results without the spatial lag of FDI Stock. Column (3) includes lagged GDP per capita. Column (4) reports results with a measure of an infrastructure sector reform. Column (5) includes a measure of human capital. Column (6) includes infrastructure and human capital. Column (7) includes country fixed effects. Column (8) reports results for 3-year-averaged data.

The baseline model reported in column (1) shows that the two measures of internal market potential – GDP per capita and population size – are both positive and significant, indicating presence of FDI driven by the market seeking motive. The coefficient of the foreign market potential is positive but not significant, which cast doubts that the export platform FDI motive played an important role on MNC location strategy in the region. The coefficient of the EU membership is

[9]See, for example, Bevan and Estrin (2004), Campos and Kinoshita (2003), Carstensen and Toubal (2004)

negative but not significant, perhaps indicating the interplay of two opposite forces – a positive effect of better market access and negative effect due of lower trade barriers which encourages more trade relative to FDI. The real wage has an expected sign but is not significant.

Column (2) of Table 3 highlights how a model that does not control for the spatial dependence in FDI biases the results in a non-trivial manner. The coefficient of the foreign market potential becomes positive, significant, and more than three times larger than in column (1). The misspecification of the model causes an upward bias because both FDI inflow and foreign market potential are positively correlated with the omitted spatial lag of log FDI stock. Similarly, the model without the spatial lag of FDI overstates the impact of domestic reforms on FDI inflows by failing to account for the positive spillovers of good governance in neighboring countries on FDI inflows (Kelejian et al., 2008).

The GDP per capita can be directly infuenced by FDI stock, especially in small open eceonomies with large capital inflows. To deal with a potential endogeneity problem, column (3) reports the equation with the lagged value of GDP per capita – the coefficient of the spatial lag of log FDI stock remains positive and significant, albeit slightly smaller than in column (1). Next, columns (3), (4), and (5) add controls for the impact of public infrastructure and human capital on FDI inflows, factors that turn out to be non-significant for the MNC location decision in the region. The equation in column (7) reports results with country fixed-effects. Controlling for time invariant unobserved characteristics does not change the main result, although factors that have low time variability, population and resources endowment, lose their significance. Finally, column (8) reports results of the estimation of the baseline model on lower frequency data computed using three-year averages. The foreign market potential becomes positive and significant, while EU membership dummy turns significantly negative, indicating an impact of substitution of FDI for exports for countries located within the EU.

5.2. Spatial autoregressive model (SAR)

In Table 4, I report the same set of equations as in Table 3, but with the spatial lag of the FDI inflows as a measure of the spatial dependence, a specification, which is more in-line with the notion of a classical spatial autoregressive process, but not as good approximation of the theoretical model. The coefficient of the spatial lag of log FDI inflow variable tends to be higher than for the spatial lag of log FDI stock variable. Other results go parallel with the results presented in Table 3.

Global and partial effects

The interpretation of the coefficients of the SAR model presented in Table 4 is different from the interpretation of the coefficients in the traditional regression models. The SAR simultaneously determines the allocation of FDI inflows in all countries within the region. A change in one of the exogenous variables in one country changes the whole spatial allocation of FDI in the region.

To illustrate this point, consider the effect of the improvement of the quality of governance in all countries of the region on the FDI inflows. Suppose that the EBRD index in each country of the region has increased by one standard deviation, which is 0.67. The partial effect of the increase is calculated according to the formula $\eta_{i,p} = 100 \times \frac{\Delta_p FDI_i}{E_t[FDI_i(t)]} = \beta_{EBRD} \times 0.67 \times E[EBRD_i(t)]$. The global effect, however, is different because it takes into account endogenous adjustments in FDI inflows, which reinforce themselves through the positive spillover feedback. The global effect, derived from the reduced form (12), is computed as $\eta_{i,g} = 100 \times \frac{\Delta_g FDI_i}{E_t[FDI(t)]} = \beta_{EBRD} \times 0.67 \times G_i \times E[EBRD(t)]$, where G_i is an $i-th$ row of the matrix $G = (I(N) - \lambda W)^{-1}$and $E_t(EBRD(t))$ is an $N \times 1$ vector of country specific mean values of the EBRD index.

Figure 1 reports the partial and global effects of the universal improvement in the quality of governance, modelled as a one standard deviation increase in $EBRD\,index$, on FDI inflows for the coefficients from the baseline regression in Table 4. The average global effect is more than 50 percent increase in FDI inflows, which is more than twice higher than the partial effect. Turkmenistan would have gained the most in relative terms, because it has the lowest period average EBRD

Table 4: Aggregate FDI inflows in transition countries: 1993-2007. Spatial lag of FDI inflows.

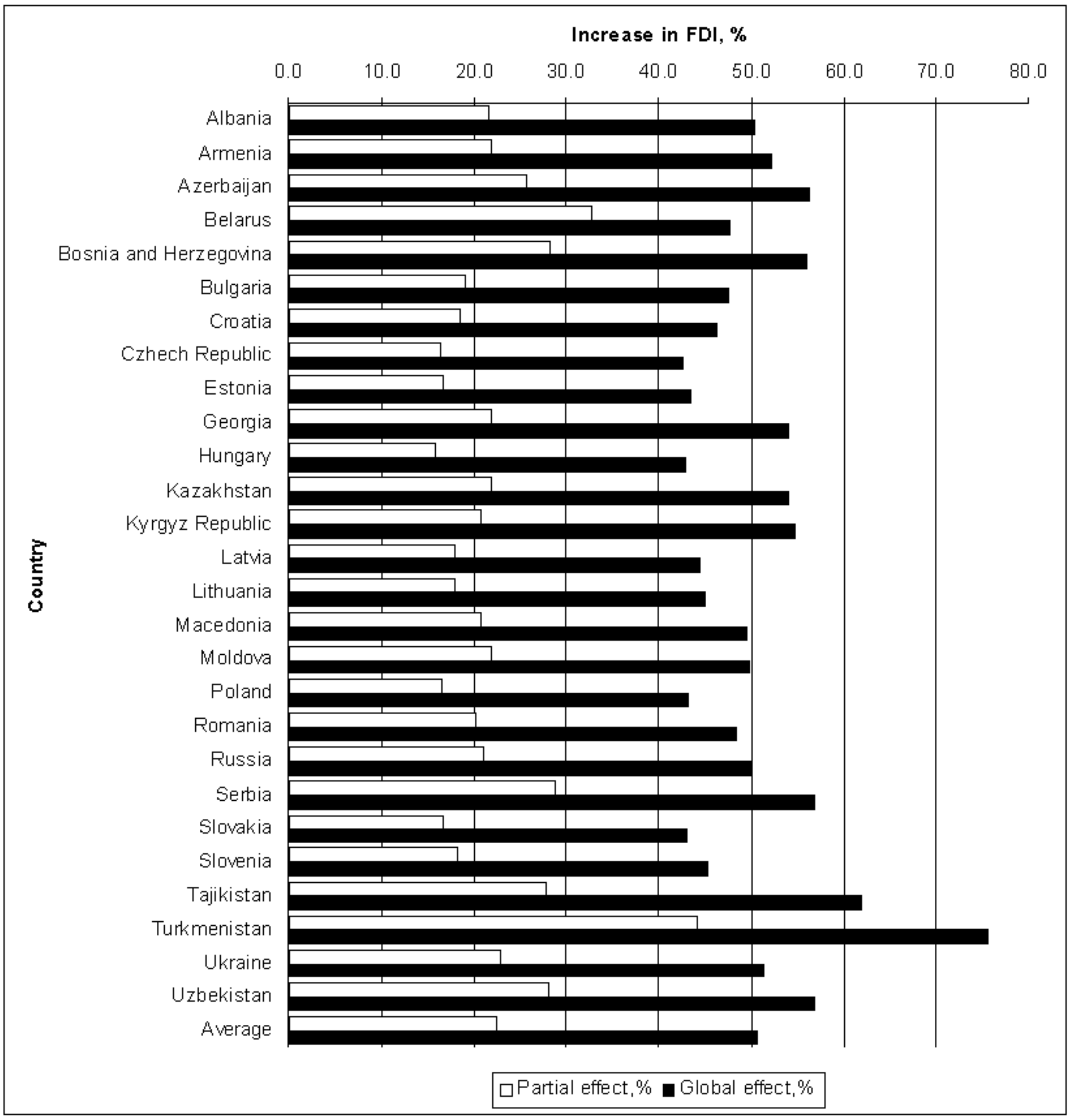
	(1) Ln FDI	(2) Ln FDI	(3) Ln FDI	(4) Ln FDI	(5) Ln FDI	(6) Ln FDI	(7) Ln FDI	(8) Ln FDI
Spatial lag of ln FDI inflow	0.57**		0.48**	0.50**	0.77**	0.68**	0.47**	0.45**
	(0.11)		(0.11)	(0.12)	(0.13)	(0.14)	(0.16)	(0.15)
Ln GDP per capita	0.55**	0.30*		0.52**	0.69**	0.64**	0.62**	0.43*
	(0.14)	(0.13)		(0.14)	(0.15)	(0.14)	(0.18)	(0.19)
Ln of population	0.36*	0.10	0.28	0.33*	0.37*	0.34*	0.15	0.20
	(0.16)	(0.15)	(0.16)	(0.14)	(0.17)	(0.16)	(1.26)	(0.17)
Ln of foreign market potential	0.081	0.87**	0.32	0.19	-0.22	-0.066	0.037	0.45
	(0.21)	(0.14)	(0.20)	(0.20)	(0.24)	(0.23)	(0.26)	(0.29)
EU membership	-0.16	-0.22	-0.14	-0.18	-0.17	-0.18	-0.14	-0.49
	(0.15)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.17)	(0.25)
EBRD index	0.88**	1.30**	0.97**	0.87**	0.80**	0.88**	1.09**	0.90**
	(0.16)	(0.13)	(0.16)	(0.16)	(0.16)	(0.17)	(0.23)	(0.19)
Ln of proven oil and gas reserves	0.25**	0.41**	0.30**	0.27**	0.24**	0.26**	0.31	0.33**
	(0.070)	(0.063)	(0.070)	(0.064)	(0.074)	(0.068)	(0.38)	(0.081)
Ln of real wage	-0.24	-0.025	-0.13	-0.22	-0.33*	-0.30*	-0.17	-0.18
	(0.15)	(0.14)	(0.14)	(0.14)	(0.15)	(0.15)	(0.16)	(0.20)
L.Ln GDP per capita			0.34**					
			(0.13)					
Infrastructure sector reform				0.054		-0.035		
				(0.13)		(0.14)		
Ln human capital					-0.65	-0.51		
					(0.56)	(0.51)		
Constant	-9.71**	-18.8**	-12.1**	-10.9**	-3.52	-6.00	-6.32	-13.4**
	(3.35)	(2.85)	(3.32)	(3.07)	(4.85)	(4.51)	(20.5)	(3.90)
R-sq. within	0.66	0.65	0.66	0.67	0.68	0.68	0.67	0.78
R-sq. bitween	0.89	0.89	0.89	0.89	0.88	0.88	0.87	0.90
R-sq. overall	0.81	0.80	0.81	0.81	0.80	0.81	0.80	0.86
Observations	376	376	376	376	361	361	376	130

Notes: Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

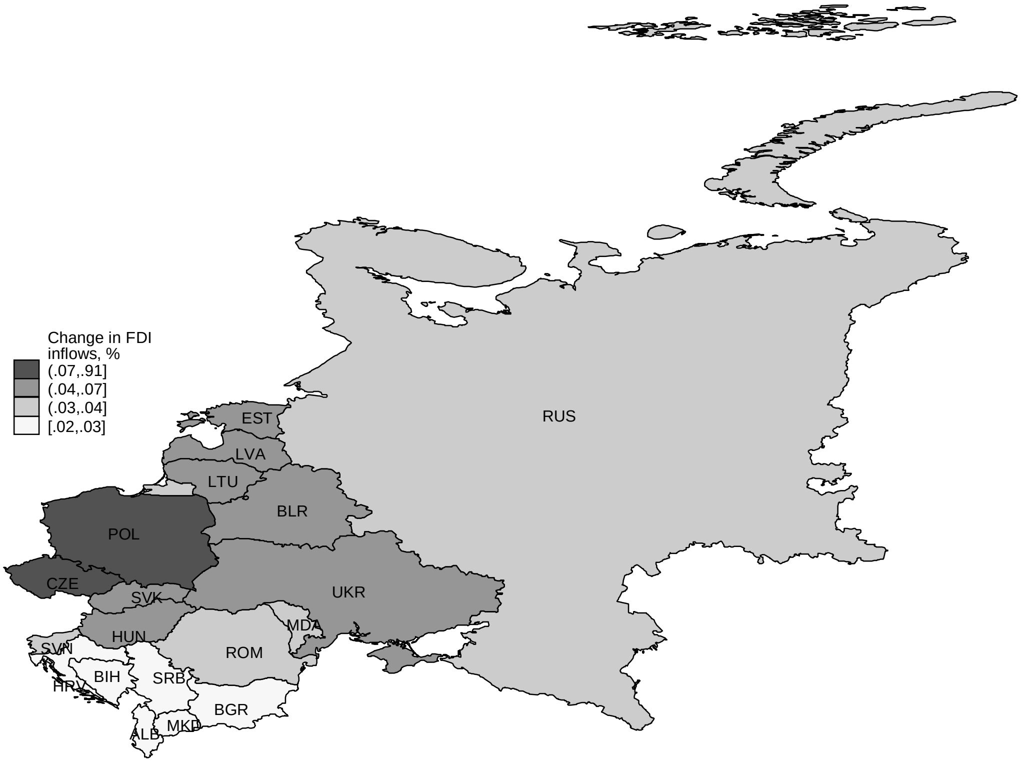
All regressions are estimated by 2SLS method using spatial lags of exogenous varaibles as instruments. Dependent variable in all regressions is ln FDI inflow. Column (1) reports the baseline regression. Column (2) reports results without the spatial lag of FDI Stock. Column (3) includes lagged GDP per capita. Column (4) reports results with a measure of an infrastructure sector reform. Column (5) includes a measure of human capital. Column (6) includes infrastructure and human capital. Column (7) includes country fixed effects. Column (8) reports results for 3-year-averaged data.

Figure 1: Partial and global effects of better governance on FDI inflows



Notes: Effect of a one standard deviation increase in EBRD index in all countries on FDI inflows. Partial effect is computed keeping FDI inflows to other countries fixed, while global effect takes into account spatial spillovers and endogenous nature of FDI inflows. The effects are computed based on the results from Table 4, column (1).

Figure 2: Global impact on FDI inflows of 1% increase in Poland's GDP per capita



Notes: Effect of a one percent increase in Poland's GDP on FDI inflows in countries of the region. The map is truncated, Central Asia and Caucasus countries are not shown index in the sample, 1.3, and a one standard deviation increase in the index would have meant 50 percent improvement in quality of governance, which would induce correspondingly high increase in FDI inflows – 44 percent increase for the partial effect and 76 percent increase for the global effect. Interestingly, there are instances of reversing order of country pair comparisons based on the partial and global effects. According to the partial effect estimates, Belarus would have gained 33 percent FDI inflows and Bosnia and Herzegovina 28 percent. However, globally Belarus would have gained 48 percent increase in FDI inflows and Bosnia and Herzegovina 56 percent. The reversion reflects the impact of location of a country relative to all other countries in the region, and it indicates that Bosnia and Herzegovina is placed better than Belarus from the MNC location standpoint.

The model can also be applied to investigate the propagation of exogenous shocks from one country to another. Consider, for example, a shock that increases GDP per capita of Poland by 1 percent. The partial effect of the shock is 0.55 percent higher FDI inflows to Poland. The global effect, displayed at Figure 2, is 0.91 percent increase in FDI inflows to Poland and higher FDI inflows to the other countries of the regions. The effect is higher in countries that are closer to Poland, and it is getting smaller with greater distance.

5.3. Results for sub-samples and different weighting matrices

As one might argue, it would be misleading to pool Eastern European (EE) and Commonwealth of Independent States (CIS) countries in one model due to different motives for investments in the two sub-regions. Columns (1) and (2) of Table 5 report results of the baseline model specification for CIS and EU sub-samples separately. The results confirm that the FDI motives are indeed different between these two groups. The FDI to the CIS region are driven by low real wages and natural resource abundance. The importance of the complex vertical FDI to the region can also be deduced from the higher value of the coefficient of the spatial lag of log FDI stock. FDI to EE countries, on the other hand, are driven by larger internal market, by positive even though not significant impact of the foreign market potential, and are more influenced by better governance.

I also consider the possibility of the structural break after the financial crisis in Russia in 1998. Columns (3) and (4) split the sample into two periods. The first period starts at the beginning of transition and lasts until 2000. The second period, characterized by more rapid FDI growth, lasts from 2001 to 2007. While the first period is characterized by high spatial dependence of FDI and importance of the internal market, the second period is characterized by smaller spatial dependence, higher importance of foreign market potential, and more resource-driven FDI inflows. Columns (5)-(8) further break the sample into four sub-groups by sub-region and sub-period. The results are consistent with the results for the larger sub-groups.

These findings point that the spatial interactions between MNCs are more important at the early stages of development when the overall stock of FDI in the region is low. At that stage, any new entrant creates a substantial spillover effect because it provides new goods and services which probably were not available before and reduces information uncertainty for other MNCs, considering entering the market. Over time, however, the market matures and additional foreign companies bring lower benefits due to diminishing marginal returns and impose higher costs on other foreign companies due to hightened competition.

The choice of the weighting matrix, as it turns out, does not impact results. Table 6 reports results of the baseline regression for different specifications of the weighting matrix, W. Column (1) reposts the results with the inverse distance squared weighting matrix for reader's convenience. Column (2) reports results with inverse distance weights. Column (3) reports results with the contiguity-based W. The main finding stands as before – high accumulation of the FDI stock in the neighboring countries is a strong, positive, and significant predictor of FDI inflow. The robustness of results to the weighting matrix specification gives more confidence in the main conclusion of the paper about complementarity of FDI inflows across the transitioning economies.

Table 5: Aggregate FDI inflows by countries and time periods.

	(1) CIS	(2) EE	(3) 1993-2000	(4) 2001-2007	(5) CIS 1993-2000	(6) CIS 2001-2007	(7) EE 1993-2000	(8) EE 2001-2007
Spatial lag of ln FDI stock	0.63**	0.27**	0.48**	0.33	0.68**	-0.049	0.29*	0.64
	(0.14)	(0.10)	(0.10)	(0.28)	(0.16)	(0.45)	(0.14)	(0.45)
Ln GDP per capita	1.04**	-0.016	0.46*	0.22	0.77**	0.53	0.021	-0.029
	(0.19)	(0.26)	(0.20)	(0.23)	(0.27)	(0.29)	(0.36)	(0.40)
Ln of population	-0.038	0.73**	0.46*	0.032	-0.014	-0.31	1.07**	0.63*
	(0.14)	(0.23)	(0.18)	(0.19)	(0.18)	(0.23)	(0.34)	(0.30)
Ln of foreign market potential	-0.18	0.44	0.12	0.90**	-0.27	1.81**	-0.00095	0.22
	(0.29)	(0.25)	(0.24)	(0.33)	(0.34)	(0.60)	(0.37)	(0.43)
EU membership		0.015		-0.17				0.12
		(0.16)		(0.15)				(0.17)
EBRD index	0.77**	1.30**	0.90**	0.83**	0.76**	1.02**	1.60**	0.77*
	(0.18)	(0.25)	(0.20)	(0.24)	(0.22)	(0.29)	(0.34)	(0.36)
Ln of proven oil and gas reserves	0.29**	0.094	0.19*	0.45**	0.27**	0.58**	-0.088	0.17
	(0.061)	(0.13)	(0.083)	(0.089)	(0.070)	(0.11)	(0.19)	(0.18)
Ln of real wage	-0.48*	-0.11	-0.25	0.055	-0.26	-0.62	-0.21	0.25
	(0.20)	(0.27)	(0.21)	(0.31)	(0.26)	(0.46)	(0.38)	(0.40)
Constant	-1.14	-19.7**	-11.6**	-19.8**	0.62	-28.1**	-16.9**	-17.2**
	(4.60)	(3.48)	(3.60)	(4.29)	(5.44)	(9.05)	(5.18)	(4.60)
R-sq. within	0.64	0.70	0.47	0.65	0.47	0.71	0.52	0.59
R-sq. beetwin	0.95	0.89	0.89	0.86	0.95	0.92	0.93	0.86
R-sq. overall	0.83	0.81	0.77	0.80	0.78	0.88	0.82	0.77
Observations	163	213	195	181	87	76	108	105

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

Dependent variable in all regressions is ln FDI inflows. Estimated by 2SLS with spatial lags of exogenous variables as instruments.

CIS sample includes Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. EE sample includes Albania, Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Serbia, Slovakia, and Slovenia.

Table 6: Aggregate FDI inflows with alternative weighting matrices.

	(1) Ln FDI	(2) Ln FDI	(3) Ln FDI
Spatial lag of ln FDI stock	0.41**	0.39**	0.33**
	(0.087)	(0.094)	(0.080)
Ln of foreign market potential	0.24	0.34	0.33
	(0.19)	(0.19)	(0.19)
R-sq. overall	0.81	0.81	0.79
Observations	376	376	376

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

Dependent variable in all regressions is ln FDI inflows.

Column (1) reports results for inverse distance squared W.

Column (2) reports results for inverse distance W.

Column (3) reports results for contiguity based W.

6. Spatial spillovers in more dissagregate data

6.1. Bilateral FDI flows

Aggregate FDI flows hide important information on the FDI source, which might introduce biases into the estimation results. Geographical proximity between the source and host countries, a common border and common language, colonial ties are all determinants of bilateral FDI flows. When aggregating the data, this information is lost in the error term, which is likely to be spatially correlated with some of the explanatory variables. For example, other things being equal, proximity to Germany could be the most important determinant of FDI inflows into the Czech Republic. Geographical proximity to Germany, in turn, correlates with the decision to join the EU, and with the market potential variable – variables that are considered as exogenous and not correlated with the error in the baseline model specification.

To check the robustness of the results reported in the previous section, I estimate the gravity based equations with the bilateral FDI stock[10] as the dependent variable and additional controls – log of distance, log of GDP per capita and log of population in the source country, colonial past, common border, and common language available from the CEPII database on bilateral distances. The number of host countries is smaller than in the previous section; the sample includes bilateral FDI stocks of 87 source countries in Eastern European countries and Ukraine in 1993 to 2007, available from The Vienna Institute for International Economic Studies (wiiw) database on FDI.

The findings presented in Table 7 are consistent with the results of the previous section, with the main distinction that the elasticity of bilateral FDI stock to the spatial aggregate FDI stock is larger than the elasticity of the aggregate FDI inflows, ranging from 0.64 to 0.82. The coefficient of the foreign market potential is positive and significant in the model with pair fixed effects, reported in column (2). The coefficient of the market potential is also significant for the 2001-2007 subsample, which probably reflects growing importance of horizontal FDI relative to vertical FDI. The traditional controls of gravity have expected signs, the elasticity of FDI with respect to distance is negative and grow over time which reflects growing regionalism within the EU, countries that share common border and colonial ties in the past have more FDI, while common language is not a significant determinant of FDI.

6.2. Disaggregated FDI: industry level data

Table 8 reports the results of the baseline model specification separately estimated for each of the NACE 2-digit level industry. The dependent variable is the log of FDI stock in country i in industry k available from the wiiw FDI database. The sample includes Eastern European countries (excluding Serbia and Montenegro), Russia, and Ukraine. To save space, Table 8 reports only the estimates of the coefficients of the spatial lag of log FDI stock and log foreign market potential. There are several interesting findings that leave open questions for the further research. First, the spatial lag of log FDI stock is positive and significant in sectors that mostly produce intermediate goods and resources – agriculture, mining and quarrying, leather, wood, fuel, metals. Second, transport equipment, rubber and plastic, other mineral products, and other manufacturing products sectors show elements of the export platform FDI strategy, having negative coefficient of the spatial lag of log FDI and positive coefficient of log foreign market potential. Third, the spatial lag of log FDI stock is significantly positive in non-tradables and services sectors – construction, trade, hotels and restaurants, financial intermediation, real estate and business activities. This result is consistent with the notion that the spatial spillovers are more important for development of infant industries. Services sector was considerably underdeveloped under socialism due to ideological and strategic reasons – the priority was given to investing in physical capital in capital intensive industries at the expense of the labor intensive sectors.

[10] Unfortunately, the data coverage for bilateral FDI inflows is small. In addition, there is a large number of zero and negative FDI inflows. Therefore, I report results for the bilateral FDI stock from country j to country i as the explanatory variable.

Table 7: Bilateral FDI inflows in tranistion countries: 1993-2007.

	(1)	(2)	(3)	(4)
Spatial lag of ln FDI stock	0.82**	0.69**	0.78**	0.64**
	(0.043)	(0.044)	(0.046)	(0.23)
Ln GDP per capita i	-0.28**	0.079	-0.025	-1.49**
	(0.10)	(0.11)	(0.12)	(0.18)
Ln of population i	0.30**	-0.036	-0.18	0.60**
	(0.11)	(1.05)	(0.11)	(0.16)
Ln GDP per capita j	0.50**	-1.06**	0.39**	1.26**
	(0.046)	(0.10)	(0.041)	(0.068)
Ln of population j	0.31**	-0.36	0.25**	0.44**
	(0.033)	(0.54)	(0.029)	(0.044)
Ln of foreign market potential	0.082	0.81**	-0.088	0.49*
	(0.10)	(0.12)	(0.12)	(0.22)
EU membership	0.023	-0.023	0	-0.17**
	(0.065)	(0.067)	(0)	(0.060)
EBRD index	0.35**	0.30*	0.34**	1.58**
	(0.11)	(0.13)	(0.11)	(0.20)
Ln of proven oil and gas reserves	0.11	-2.53**	0.36**	-0.15
	(0.068)	(0.22)	(0.067)	(0.098)
Ln of real wage	0.63**	0.64**	0.12	0.97**
	(0.11)	(0.11)	(0.14)	(0.21)
Ln distance	-0.46**		-0.29**	-0.67**
	(0.065)		(0.057)	(0.089)
Common border	0.55**		0.51**	1.10**
	(0.21)		(0.19)	(0.29)
Colony	0.88**		0.66*	1.17**
	(0.31)		(0.28)	(0.41)
Common language	-0.69		-0.85	-0.78
	(0.52)		(0.48)	(0.70)
Constant	-20.1**	-15.8	-6.20**	-36.7**
	(1.94)	(18.5)	(1.89)	(2.72)
R-sq. overall	0.45	0.0044	0.35	0.46
Observations	7321	7321	3796	3525

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$

Dependent variable in all regressions is ln FDI stock of country j in country i. Column (1) reports the baseline gravity specification. Column (2) includes pair fixed effects. Column (3) reports the baseline model in 1993-2000. Column (4) reports the baseline model in 2001-2007

Table 8: FDI stocks by NACE 2 letter sectors: 1993-2007

NACE	Description	WlnFDI	lnFMP	Adj. R-sq.	Obs.
AB	Agriculture	0.85* *	-1.15**	0.78	143
C	Mining and quarrying	1.98**	-0.62**	0.73	140
D	Manufacturing	0.18	0.24*	0.9	148
DA	Food products	0.024	-0.12	0.82	137
DB	Textiles	-0.27	0.34*	0.74	120
DC	Leather	0.89**	0.94**	0.57	93
DD	Wood	0.49*	-0.57**	0.75	121
DE	Paper	-0.27	-0.061	0.78	104
DF	Fuel	3.12**	-0.23	0.48	86
DG	Chemicals.	-0.43**	0.13	0.86	125
DH	Rubber and plastic	-0.057	0.52**	0.91	120
DI	Other mineral pr.	0.15	0.52**	0.85	114
DJ	Metals	1.05**	0.53*	0.69	137
DK	Machinery and equipment	0.21	0.35	0.84	121
DL	Electrical and optical	0.066	-0.17	0.87	125
DM	Transport equipment	-0.25	1.00**	0.79	126
DN	Manufacturing n.e.c.	-1.02**	1.61**	0.3	112
E	Electricity, gas and water supply	0.6	0.17	0.57	132
F	Construction	0.69**	0.41**	0.84	145
G	Trade	0.30**	0.035	0.87	148
H	Hotels and restaurants	0.44**	-0.27	0.68	143
I	Transport and communication	0.98**	-0.21	0.73	148
J	Financial intermediation	0.69**	-0.03	0.84	148
K	Real estate and business activities	0.81**	-0.50**	0.86	148
M	Education	0.37	-0.57*	0.49	72
N	Health and social work	0.43	-0.39	0.5	83
O	Other services	0.31	-0.21	0.75	104

Baseline model specification separately estimated for each of the NACE 2-digit level industry. The dependent variable is the log of FDI stock in country i in industry k available from the wiiw FDI database. The sample includes Eastern European countries (excluding Serbia and Montenegro), Russia, and Ukraine.

7. Conclusions

This paper estimates the degree of spatial spillovers of FDI and influence of foreign market potential on FDI in transition countries during 1993-2007. Previous research has emphasized the importance of the foreign market potential for FDI location. More recently, the importance of spatial spillovers for outward FDI activities of US firms found to be important, although not robust for different groups of countries. This study finds a substantial complementarity of FDI in transition countries which is robust to different model specifications and different aggregation of data. The foreign market potential, on the other hand, is not always a significant determinant of FDI.

As the analysis of sub-samples of the data indicates, the FDI complementarity is extremely important for new markets, such as services sector which was substantially underdeveloped in the socialist countires, but the complementarity weakens when the market matures and the size of internal and external markets starts playing a dominant role in the FDI location decision. It also indicates differences in dominant modes of FDI in the two sub-regions – more horizontal FDI in the EE region, and more complex vertical FDI in the CIS region. The spillovers are more pronounced for the CIS countries, while the foregin market potential is not statistically significant. At the same time, the spatial spillovers are not significant for the EE countries during 2001-2007. The positive spatial spillovers of the FDI stock in neighboring countries on FDI inflows into a country are stronger at the early stages of transition – an additional indication that FDI spillovers are more pronounced at the earlier stages of development.

The outlined facts bring about an important policy implication – internalizaion of spatial spillovers across different countries in a region (e.g. by coordinating efforts) substantially increases chances to attract FDI to poor, developing countries.

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